

Name of Project: Competitive Program for Science Museums, Planetariums, and NASA Visitor Centers Plus Other Opportunities (CP4SMPVC+) [Competed in 2013 and Awarded in 2014 with FY13 Funds via NASA Research Announcement (NRA): NNH13ZHA001N]

Number and Type of Agreements Used: 10 (grant, cooperative agreement, intra-agency transfer)

Project Co-Managers: Mary F. Sladek/Anita Sohus

Center: Headquarters/ JPL

Telephone Numbers: 202-358-0103/818-354-6613

PROJECT DESCRIPTION

The NASA Research Announcement (NRA) NNH13ZHA001N entitled Competitive Program for Science Museums, Planetariums, and NASA Visitor Centers Plus Other Opportunities (CP4SMPVC+) is authorized by PL (Public Law) 109-155 SEC. 616. MUSEUMS: "The Administrator may provide grants to, and enter into cooperative agreements with, museums and planetariums to enable them to enhance programs related to space exploration, aeronautics, space science, earth science, or microgravity." Historically, Congressional appropriators have dedicated funds for "a competitive program as authorized by section 616 of PL 109-155." In Fiscal Years 2008, 2009, and 2010, Congress reallocated NASA's Office of Education budget request in order to fulfill this direction.

In FY 2008 and FY 2009 NASA issued two NRAs (NNH08ZNE006N and NNH09ZNE005N), that shared the title: *Competitive Program for Science Museums and Planetariums* (CP4SMP). A total of 13 projects were selected for award using the FY 2008 funds. The FY 2009 NRA (also known as the "call for CP4SMP proposals") NNH09ZNE005N specified that, "Should Congress continue funding CP4SMP in FY 2010, NASA may select FY 2009 proposals for funding rather than open a new competition." A total of 18 projects were selected for award using FY 2009 and FY 2010 funds from the proposals received under the FY 2009 NRA.

Between FY 2008–FY 2010, Congress also reallocated the Office of Education's budget to establish a separate Visitor Center (VC) initiative. Congress directed NASA Visitor Centers to support the development of educational activities in science, technology, engineering, and mathematics (STEM).

In 2011, a new solicitation (NNH11ZHA004N) consolidated prior years' investments in NASA Visitor Centers, museums and planetariums under the *Competitive Program For Science Museums and Planetariums Plus Opportunities for NASA Visitor Centers and Other Informal Education Institutions* (CP4SMP+). No funding was available for awards in FY 2011. In FY12, 18 projects, including 7 NASA Visitor Centers, were selected using FY 2012 funds from the proposals submitted to the 2011 NRA.

In 2013, NASA's Office of Education's consolidation efforts continued under a new solicitation (NNH13ZHA001N) entitled: *Competitive Program for Science Museums, Planetariums, and NASA Visitor Centers Plus Other Opportunities* (CP4SMPVC+). Appendix O provides an avenue for entities not eligible to apply for the competition to submit an unsolicited education proposal using NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES). The 2013 NRA, also known as "Informal STEM Education," is one of roughly 40

NASA activities published as part of the March 2014 Progress Report on Coordinating Federal Science, Technology, Engineering, and Mathematics (CoSTEM) Education.

PROJECT GOALS

The basic goal of the CP4SMP+ solicitation is to further NASA Strategic Goal 6: “*Share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.*” A primary (but not the only) sub goal of this solicitation is to achieve NASA’s flagship investment in Outcome 6.2: *Promote STEM literacy through strategic partnerships with formal and informal organizations.*

Specific project-level objectives may include but are not limited to:

- Promote life-long learning in America by students, educators, families, and retirees, using NASA-themed STEM and missions via non-formal and informal education.
- Encourage, inspire and engage large and diverse audiences via NASA’s contributions to everyday life within the Congressionally defined technical areas (NASA-themed space exploration, aeronautics, space science, earth science, or microgravity, or combinations of these themes).
- Improve understanding of NASA’s missions, contributions to STEM disciplines, and STEM careers, including by faculty in pre-K-12 and higher education settings.
- Link and engage providers of informal and formal education, including institutions of higher education, particularly HBCUs, Tribal Colleges, and other minority-serving institutions, using NASA content through pilot projects that enable educators, parents, retirees, or community leaders to carry the NASA content back to their households, school, after-school groups, summer camps, 4-H communities, etc.

PROJECT BENEFIT TO OUTCOME 6.2

CP4SMPVC+ primarily addresses Outcome 6.2: *Promote STEM literacy through strategic partnerships with formal and informal organizations.* It also supports outcomes 6.3 and 6.4 of the NASA education strategic coordination framework: *Engage the public in NASA’s missions by providing new pathways for participation and inform, engage, and inspire the public by sharing NASA’s missions, challenges, and results.*

The CP4SMPVC+ funding opportunity supports NASA’s education goal to promote STEM literacy through strategic partnerships with formal and informal organizations by encouraging such partnerships in proposals submitted to the NASA Research Announcement (NRA). The CP4SMPVC+ community is encouraged to network with each other and explore partnership opportunities. The CP4SMPVC+ opportunity is uniquely positioned among NASA’s competitive grant and cooperative agreement broad agency announcements because all NASA missions in exploration, aeronautics, science or space operations are eligible for support. CP4SMPVC+ also contributes to education more broadly by making NASA’s remarkable resources—facilities, missions, data, images, and employees, including internationally known engineers and scientists—more broadly known. CP4SMPVC+ grants are expected to encourage inquiry-based or hands-on education or learning focused on NASA’s contributions to the STEM disciplines.

PROJECT ACCOMPLISHMENTS

NASA's Office of Education, in cooperation with NASA's Offices of Communications, Chief Technologist and Mission Directorates (i.e., Aeronautics Research, Human Exploration and Operations, and Science), solicited proposals for uniquely NASA education or research engagement projects, exhibits and/or partnerships with K-12 schools to support inquiry- or experiential-based activities led by informal education institutions that feature NASA missions, science, engineering, explorations, or technologies. The 2013 CP4SMPVC+ NASA Research Announcement was released on 9 January 2013 and proposals were due 9 April 2013. Total number of proposals received: 74. Categories of proposals under review: 6 unsolicited proposals, 1 neither competitive nor unsolicited proposal, and 67 external review eligible proposals.

The sixty-seven (67) competition-eligible proposals came from 31 states, the District of Columbia, and Puerto Rico. These 67 proposals requested amounts ranging in value from about \$190,000 to over \$1,265,000. Submitting organizations included museums, planetariums, NASA Visitor Centers, Challenger Centers, aquariums, and other institutions of informal education. These 67 proposals were reviewed through a merit-review process, which included consulting with experts external to NASA. Representatives from NASA's Office of Education, Office of Communications, and Mission Directorates served as internal reviewers. All awards have a maximum five-year period of performance. NASA could elect to make a full or partial selection of a proposal. Ten projects, including four NASA Visitor Centers, were selected to receive FY13 funds.

Short abstracts for the 10 FY 2013 and prior years' selections are available at: <https://informal.jpl.nasa.gov/museum/CP4SMP/Program> under the heading *Summary of FY2008-2013 Awardees*.

In FY 2013, the following projects were completed: one project from the FY2008 cohort (American Museum of Natural History); two projects from the FY 2009 cohort (Museum of Science and Industry-Tampa and Oregon Museum of Science and Industry); one project from the FY 2010 cohort (The Childrens' Museum of Indianapolis), and three projects from the FY12 cohort (Goddard Space Flight Center Visitor Center, Museum of Aviation, and Stennis Space Center). Periods of performance ranged from one to five years. Highlights from the results of these grants are listed in the *Project Partners* section below.

In January 2013, representatives from the 2012 cohort of awardees, as well as their NASA Technical Officers, participated in a reverse site visit hosted by the NASA Shared Services Center (NSSC), Stennis Space Center, and the Jet Propulsion Laboratory. The visit was held at Infinity, the visitor center for Stennis Space Center. Attendees included CEOs or high-level executives from the FY 2012 cohort, as well as the Technical Officers for these grants, and representatives from the NASA Visitor Centers, NSSC, the NASA Office of the Inspector General, the NASA Office of Equal Opportunity and Diversity, and NASA Office of Communications.

PROJECT CONTRIBUTIONS TO APG MEASURES

NASA Education FY13 Annual Performance Goal APG 6.4.1.1 (ED-13-5) stated, "*Maintain the NASA Museum Alliance and/or other STEM Education strategic partnerships in no fewer than 30 states, U.S. Territories, and/or the District of Columbia.*" This APG was achieved by the Museum Alliance, a free-of-charge nationwide network of informal education professionals in all

50 states, DC, Puerto Rico, and Guam, as well as nearly 20 other countries. These educators work at more than 550 science centers, planetariums, museums, aquariums, zoos, observatory visitor centers, NASA visitor centers, Challenger Centers, nature centers, park visitor centers and similar organizations. The Museum Alliance was created and is managed by JPL. All CP4SMPVC+ awardees are required to participate in the Museum Alliance.

IMPROVEMENTS (E.G., PROJECT MANAGEMENT, EFFICIENCIES, ETC.) MADE IN THE PAST YEAR

The NASA/JPL team reviewed and selected proposals at the same time they were planning and implementing a Reverse Site Visit for awardees and technical officers, demonstrating clear communications and definition of roles, as well as effective business processes. This was accomplished in part through the addition of civil servant technical officers to the NRA located at Marshall Space Flight Center and Glenn Research Center.

Grantees at the Site Visit developed action plans for future collaborations with NASA, NASA Visitor Centers, and other grantees and partners. Evaluation of the site visit indicated significant value to the awardees and other participants. JPL continued development of a community of practice comprising the CP4SMPVC+ awardees to help them navigate NASA policies and processes including use of the NASA emblem, review of communications materials and educational products, grants processes and resources, and reporting requirements.

JPL continued to refine a spreadsheet system to streamline data collection for reporting requirements. JPL also convened a session with awardees who were attending the Association of Science-Technology Center (ASTC) annual conference in October 2012 in Columbus, OH. JPL manages communications through a listserv for CP4SMPVC+ awardees and the CP4SMPVC+ Technical Officers at the NASA Centers and HQ. JPL has also developed and maintains a CP4SMPVC+ Community website which includes answers to frequently asked questions for both awardees and technical officers, as well as copies of materials presented at the reverse site visit. In order to document more details of the accomplishments of the grants and cooperative agreements, JPL made significant progress in developing a public CP4SMPVC+ website for launch in December 2013 at <https://informal.jpl.nasa.gov/museum/CP4SMP> .

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Thirty projects from five cohorts (2008-2013) were active for all of FY13. Seven projects were completed in FY13.

Highlights from awardees' progress reports include educator professional development, student and family programs, public programs, exhibits and show openings:

NNX09AL36G (FY 2008 Cohort) American Museum of Natural History, NY.

NASA Science Research Mentoring Program is an established mentoring program with a goal of motivating and preparing high school students from New York City, especially those underrepresented in science, technology, engineering and math (STEM) fields, to pursue STEM careers related to Earth and Planetary Sciences and astrophysics through cutting-edge, research-based courses and authentic research opportunities. NASA SRMP consists of a year of Earth and Planetary Science (EPS) and Astrophysics electives offered through the Museum's After School

Program, year-long mentorship placements with Museum research scientists, and summer programming through education partners at City College of New York and the NASA Goddard Institute for Space Studies. Five courses were developed with NASA funding: DIY Astronomy, Dynamic Earth, Solar System, Stars, and Wonderful Universe. 443 students completed the courses over the 4 years of the program, and of those 72 went on to participate in the summer mentorship program under a research scientist.

Project Websites:

<http://www.amnh.org/learn-teach/grades-9-12/science-research-mentoring-program>

<http://www.amnh.org/learn-teach/grades-9-12/science-research-mentoring-program/srmp-curricula-for-teachers>

NNX10AK17G (FY 2010 Cohort) Pacific Science Center, WA.

NASA Now: Using Current Data, Planetarium Technology and Youth Career Development to Connect People to the Universe uses live interpretation and new planetarium technology to increase awareness, knowledge and understanding of NASA missions and STEM careers among schoolchildren, teens and the general public. The project includes a goal to engage underrepresented high school students through a long-term youth development program focused on Earth and space science that provides first-hand knowledge of science and careers within the NASA enterprise along with corresponding educational pathways. In the first 2 years of this project, the Discovery Corps Track for Earth and Space Science Achievement (TESSA) program has involved 22 teens for their 4-year experience with the museum, who are working on NASA citizen science projects Zooniverse and S'COOL and leading activities at the museums' Astronomy Day celebration. The museum is targeting 40 students total (for 4 years each) during the 5-year duration of the project.

Project Website: <http://www.pacificsciencecenter.org/Discovery-Corps/discoverycorps>

NNX09AL79G (FY 2008 Cohort) ExplorationWorks, MT.

The goal of *Montana's Big Sky Space Education: the NASA ExplorationSpace at ExplorationWorks* is to stimulate interest in human space exploration and STEM careers in communities across Montana through exhibits, field trips, STEM classes, and public presentations by ethnically diverse NASA women scientists and engineers. The project's component aimed at women and girls featured a Spacesuit and Mission Operations exhibit with designs for Low Earth Orbit and future human planetary missions, and highlights the contributions of women and minorities in NASA space research and exploration. In May 2013 *Shoot for the Sky* exhibit opened and included graphic panels of women in aerospace and spacesuit development, Knowledge Station, Helmet Display, Mars Rover, Straw Rocket Launchers, and the Biosuit. This was accompanied by a distinguished speaker series and videoconferences for elementary schools by women scientists. ExplorationWorks expanded robotic and engineering programs aimed at grades 3 – 8 by through four 10-week sessions of Girl-Tech classes (reaching 48 students), and collaborated with Carroll College to train 15 high school girls in math modeling and robotics programming. ExplorationWorks partnered with Dr. Dava Newman, MIT Professor of Aeronautics and Astronautics, and Dr. Angela DesJardins of the Montana Space Grant Consortium at Montana State University.

Project Website: <http://www.explorationworks.org/exhibits/>

NNX09AL70G (FY2008 Cohort) Denver Museum of Nature & Science, CO.

Methods of Increasing Awareness of Comparative Planetology and Climate Science with Science On a Sphere in Museum Settings is intended to educate audiences about planetary exploration missions, illuminate climate science through comparative planetology, and to produce new educational materials, interpretation techniques, and knowledge that will facilitate more effective informal education on these themes nationally. This project contributes to the development of a workforce that uses digital display technology (NOAA's Science on a Sphere) to communicate earth and planetary concepts to the public and educators by evaluating the effectiveness of different modes of employing these innovative, rapidly proliferating, visually compelling but inadequately tested SOS display systems. The Sphere has served as one of their greatest tools for engaging and inspiring visitors across the Museum. DMNS staff believes that SOS is best used as a tool to connect inquiring minds with eager educators. At the museum, an "SOS ProtoTeam" provides feedback on the dozens of SOS playlists that the museum develops and 220 trained Museum Galaxy Guide docents present the information to guests. Museum staff are presenting at professional conferences regarding the findings from SOS evaluation and volunteer training.

NNX10AD87G (FY2009 Cohort) Rochester Museum & Science Center, NY.

NASA Science and Technology on the Family Calendar investigated the possibility of using local public and charter schools to recruit groups of families with middle-school-age children who would meet regularly to create NASA-themed programs for presentation to the general public at the Rochester Museum & Science Center (RMSC). The lead institution was the Rochester Museum & Science Center, in partnership with the Insight Lab at the Chester F. Carlson Center for Imaging Science of the Rochester Institute of Technology. Six cohorts produced their own public event running from one to ten days at RMSC: "Planet Next: Where Are We Going and How Will We Get There?," "Space Odyssey: Colonization of Space," "Lasers," "Aliens: Friend or Foe?," "Evolution of Electronics" and "Our Home Planet." These events were created during 105 family meetings attended by 269 unique individuals (including children of all ages and adults) and seen by an estimated 5910 RMSC visitors.

NNX09AL31G (FY2008 Cohort) Miami Science Museum, FL.

Youth EXPO: Youth Exploring the Potential of Virtual Worlds was a proof-of-concept study to determine if an immersive 3D virtual environment is an effective medium to increase high school students' understanding of current climate change research and to motivate interest in learning more about climatology-related careers. The project was conducted by the Miami Science Museum in partnership with Goddard Institute of Space Sciences and Goddard Space Flight Center, and implemented with 55 high school students in Miami. While a large percentage of Saturday Academy participants were interested in being a computer programmer or an engineer on both the pre- and post-surveys, there were substantial increases in students' interest in becoming a physicist (+23%), an astronomer (+23%), or a biologist (+20%).

Project Website: <http://www.miamisci.org/~youthexp/>

NNX10AK14G (FY 2010 Cohort): Arizona Sonora Desert Museum, Tucson, AZ.

Laurel Clark Earth Camp opens eyes and minds to our unique, interdependent and awe-inspiring planet, drawing connections from our homes, to our region, to the globe, and to what we can learn about Earth from space. Earth campers work in teams to develop awareness and understanding of our planet's ecosystems and how to better live in harmony with the natural

world. This is illustrated by the story of Kevin Weatherbee, a fourth-grade teacher at Otondo Elementary School in Yuma, Arizona, on the U.S.–Mexico border. In his school district, 42% of the population is Hispanic, 20% are foreign-born, and 33% speak English as a second language. Mr. Weatherbee participated in the Laurel Clark Earth Camp for Educators in 2013, a yearlong professional development program designed to help teachers support their students' natural curiosity by giving them tools and practices to guide student investigations of the real world. Mr. Weatherbee used his Earth Camp experience to introduce students to satellite imagery available via Google Earth and Earth Engine. Their first investigation was tied to the book, *Two Lands, One Heart*. To help his students understand more about the book's setting, he let them explore satellite images of Vietnam and helped them find data to answer their questions about differences in climate and agriculture compared to Yuma. Mr. Weatherbee was also able to help his students use satellite data to investigate a local environmental change—the decrease in ladybugs on their playground. Students viewed images of surrounding fields over time to see if they could see changes in crops or green-ness. This investigation was inconclusive, but led to further questions about pesticide use, which seemed to hold the answer.

Project Website: <http://www.desertmuseum.org/earthcamp/>

NNX10AK115G (FY2010 Cohort): Maryland Academy of Sciences, Baltimore, MD.

Maryland Science Center's *Astrobiology* project has had a number of positive impacts with public, student, teacher, and underserved audiences. More than half a million visitors to MSC have experienced the Life beyond Earth exhibit, 179 teachers took part in four day-long workshops, and nearly 1,000 underserved students from nearby schools were provided free transportation to visit both the exhibit and the Davis Planetarium program *We Are Aliens*. In the 2013 educator workshops 70 of the 82 participants were female. The scientists who presented at the workshops were Dr. Amy Simon-Miller from NASA Goddard Space Flight Center and Dr. Jocelyne DiRuggiero from Johns Hopkins University.

The MSC project team also worked with Maryland School for the Blind teachers and students to develop tactile exhibit elements, including a Milky Way model, extremophile microbe models and three relief sculptures of Solar System worlds—Mars, Europa and Titan. They provided feedback on prototypes of each of the tactiles, which generated better exhibit experiences for visitors with vision limitations. The School also advised on and produced Braille and Large Print guides for the exhibit.

Project Website: <http://www.mdsci.org/exhibits/life-beyond-earth/>

NNX09AL38GG (FY2008 Cohort): Montshire Museum of Science, VT.

The Dynamic Earth project has profoundly impacted the Montshire Museum of Science's ability to deliver high-quality exhibits and programming around earth processes not only directly to visitors and students but also through our work with teachers. Over the past five years they have developed a number of full-day teacher professional development workshops covering plate tectonics, the rock cycle, stream dynamics, and weather that provide student lessons, teaching materials, and teacher enrichment allowing their reach to extend far beyond the Museum's walls. Extended professional development opportunities have expanded the capacity of nearly 50 teachers in rural, underserved communities in Vermont and New Hampshire. For example, Tammy Russell, a 7th and 8th grade teacher at Walden Elementary School in Vermont first

participated in the teacher workshop *Stream Dynamics* in 2011. She now brings her students each year to Montshire's student workshop *River Formation* where students model stream formation using dripper bottles and tubs of diatomaceous earth and examine NASA satellite imagery of local rivers such as the Connecticut River. Additionally, Ms. Russell borrows a "lending set" of stream tables from the Montshire and allows her students to expand on experiments started in the workshop and develop new investigations.

Project Website: <http://www.montshire.org/exhibits/sound-hearing/dynamic-earth-exhibition-created-by-the-montshire-museum/>

NNX12AK98G (FY2012 Cohort): Virginia Air and Space Center, Hampton, VA.

In 2012, the Virginia Air & Space Center (VASC) launched *The VASC: Creating an Exciting NASA Inspired Informal Education Program* featuring a series of teacher professional development workshops, classroom (outreach) visits to students of those teachers, on-site educational experiences for those students, and collected surveys from the teacher and student participants for evaluative analysis. Through November 2013, the VASC served 105 formal and informal educators through professional development workshops focusing on STEM subjects and incorporating NASA resources, activities, and exhibits; of these teachers, 100 were women. NASA materials were aligned to the Virginia Standards of Learning guidelines for ease of integration into the teachers' curricula. Evaluation assessments were performed before each NASA STEM content exposure to develop trend analysis from start to finish and for each component's effect on the students' impressions of NASA and the STEM lessons they have absorbed. Career views were analyzed as well. By sampling from across NASA's Directorates, we kept the material fresh and our audience interested. This approach assisted us in stimulating interest in STEM subjects and careers through hands-on, minds-on education for all ages.

At the conclusion of the program, a significantly larger percentage of students reported that each of the six assessed expectations had actually been met to a greater extent than was initially anticipated. Additionally, this project inspired new collaborations with local school districts for STEM initiatives. VASC is partnering with Newport News Public Schools to infuse robotics in math labs at highest priority schools. VASC has also been ingrained in Newport News Public Schools Saturday STEM Academy, which helps provide additional support to students who are performing below the standards by integrating hands-on STEM activities. We also partnered with Virginia Beach Public Schools to develop a Summer STEM Academy for Title One students. Formal teachers work with our informal educators to combine both teaching styles for greater engagement. We are also working with their highest priority school to create a mentorship program. We will follow a group of students with lowest test scores into middle school and continue to expose them to NASA STEM.

A complete list of the FY 2008, 2009, 2010, 2012, and 2013 CP4SMP selections including short abstracts can be found at the following URLs on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES):

2008:

<http://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=192240/Selected%20Proposals%20CP4SMP%202008.pdf>

2009:

[http://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=216807/2009%20S election%20Table.pdf](http://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=216807/2009%20S%20election%20Table.pdf)

2010:

<http://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=229483/2010%20S election%20Table.pdf>

2012:

[http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId=%7B75AAC7 BF-2F69-6C73-2980-B1DCF25EA665%7D&path=closed](http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId=%7B75AAC7BF-2F69-6C73-2980-B1DCF25EA665%7D&path=closed)

(see separate table for NASA Visitor Centers)

2013:

[http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId=%7B37764C2 A-F415-01DF-1B30-F1971BE7F8BE%7D&path=closedPast](http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId=%7B37764C2A-F415-01DF-1B30-F1971BE7F8BE%7D&path=closedPast)

(Note: There is also a separate table for two projects that competed among the 67 proposals and were funded by the Minority University Research and Education Project which brings the total number of awards funded using FY 2013 funds to 12 under this NRA.)